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A Procedural Evaluation of an Analytic-Deliberative Process: The Columbia River Comprehensive Impact Assessment

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A Procedural Evaluation of an Analytic-Deliberative Process: The Columbia River Comprehensive Impact Assessment

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The U.S. Department of Energy's Columbia River Comprehensive Impact Assessment (CRCIA) was an ambitious attempt to direct its cleanup of the Hanford Nuclear Reservation toward the most significant risks to the Columbia River resulting from past plutonium production. DOE's approach was uncommonly open, including tribal, regulatory agency, and other Hanford interest group representatives on the board that was to develop the assessment approach. The CRCIA process had attributes of the ''analytic-deliberative'' process for risk assessment recommended by the National Research Council. Nevertheless, differences between the DOE and other participants over what was meant by the term ''comprehensive'' in the group's charge, coupled with differing perceptions of the likely effectiveness of remediation efforts in reducing risks, were never resolved. The CRCIA effort became increasingly fragmented and the role its products were to play in influencing future clean-up decisions increasingly ambiguous. A procedural evaluation of the CRCIA process, based on Thomas Webler's procedural normative model of public participation, reveals numerous instances in which theoretical-normative discourse disconnects occurred. These had negative implications for both the basic procedural dimensions of Webler's model—fairness and competence. Tribal and other interest group representatives lacked the technical resources necessary to make or challenge what philosopher Jurgens Habermas terms cognitive validity claims, while DOE and its contractors did not challenge normative claims made by tribal representatives. The results are cautionary for implementation of the analytic-deliberative process. They highlight the importance of bringing rigor to the evaluation of the quality of the deliberation component of risk characterization via the analytic-deliberative process, as well as to the analytic component.

KEY WORDS: Analytic-deliberative process; discourse analysis; Hanford Nuclear Site; nuclear weapons complex cleanup; procedural-normative evaluation

1. INTRODUCTION

Conducting risk assessments for environmental hazards in ways that embrace both scientific norms and public values, including expectations regarding public participation, remains an elusive goal. Although public participation provides numerous benefits to agency decision making, involvement of citizens does not necessarily reduce conflict or lead to more widely accepted decisions. In some cases the

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participation procedures themselves can become a new source of conflict.[1] Yet information regarding procedural deficiencies of past participatory experiences is not commonly identified and disseminated. Critical evaluations of citizen advisory boards generally emphasize outcome, while process variables receive less attention.[2] This shortcoming has hampered effective learning and feedback for improving participatory mechanisms. The case study developed in this article demonstrates a process for procedural evaluation of participatory risk assessments and underscores the importance of incorporating attention to procedural questions into the design of such assessments.

Notable among efforts to elaborate on how to involve citizens and interest groups in the conduct of risk assessments is the National Research Council's proposal for an ''analytic-deliberative'' process.[3] This proposal and, to an extent, earlier studies by NRC committees, beginning with the ''red book'' on risk assessment and management,[4] address a wide range of issues relevant to the joint participation by laypersons and experts in assessment and management of socially relevant risks.

Typically, however, such proposals come out of committee processes dominated by risk assessment practitioners whose personal experiences and understandings about ''what's wrong'' with the nation's approach to risk assessment and management strongly color the nature of the remedies proposed.[5] This atheoretical approach to design can render the participatory models proposed difficult to evaluate in broader social and political terms.[6] Even if one were to craft experimentally an example application of the NRC's analytic-deliberative approach, the analyst's conclusions about its workability in engaging stakeholders will likely depend on the importance he or she attaches to the influence of any of a number of context-specific factors. To an extent then, the twin problems of crafting and evaluating approaches to increasing the quality of participation in, or acceptance of, risk assessment are embedded within the larger problem that Jasanoff refers to as the ''two cultures'' of risk assessment.

From Jasanoff's social perspective, risk assessment can come across as incomplete when inadequate attention is paid to problems of ''scale'' (spatial, temporal), ''interactivity'' (extent to which risks are socially determined), and ''contingency'' (context dependency) in the construction of risk scenarios.[5] The public's lack of trust in those who oversee risky technologies, coupled with risk managers' lack of understanding of the dynamics of the processes by which public trust can be destroyed, also contribute to the failure to find acceptance of many public risk management efforts.[7,8] Issues of public trust seem especially to have hindered the public's acceptance of nuclear technologies and federal programs for the management of nuclear wastes.[8,9] Still another perspective, one influenced by ''direct participation'' theories of democracy formulated by political scientists, argues that ''effective participation is unlikely … if large resource inequalities exist among participants'' (p. 348).[10] This latter condition seemingly typifies the situation at the larger, more remote U.S. Department of Energy (DOE) sites where the great bulk of the legacy wastes of the nuclear weapons production era are now stored.[11,12]

Political scientists can bring more unified theoretical perspectives to the problem of engaging the public in technological decision making, but competing theoretical frameworks leave the analyst with the normative question of which criteria are most appropriate when evaluating instances of public participation, or model frameworks by which it might be effected.[13,14] The latter two authors evaluate in general terms the strengths and weaknesses of commonly employed models for involving members of the public or public interest groups in technological decision making. In our experience, however, and in part for reasons noted above, the public processes developed to engage stakeholders in public risk debates are likely to be hybrids difficult to classify in terms of standard models of participation.

This dilemma is largely avoided if we take the path advocated by Thomas Webler and shift our focus instead to the micro level where, ''by and large, participation is *interaction among individuals through the medium of language* (emphasis in original, p. 40).[15] Webler argues that macro-level theories of democracy do not address the question of *which* modes of public participation lead to better understanding. We believe that Webler's approach, which is based on theories of the use of language (i.e., pragmatics, as embodied in the work of Habermas[16,17]), can provide useful insights at the level where the importance of characteristics of risk debates like those pointed to by Jasanoff, Slovic,[5,8] and others can be assessed.

In this article we utilize Webler's framework for evaluating participation from a procedural

perspective to examine a recent participatory risk assessment conducted under the aegis of the DOE. Our focus is an ambitious attempt by the DOE's Richland Field Office (DOE-RL) to engage Indian tribes, regulators, and other members of the eastern Washington stakeholder community in a comprehensive assessment of the risks posed by contaminants released at the Hanford Nuclear Reservation to the resources of the Columbia River (the Columbia River Comprehensive Impact Assessment, known as the CRCIA). Because the CRCIA was in general terms structured along lines similar to those of the analytic-deliberative process advocated by the National Research Council, our assessment also provides a basis for comment on the implementation of that approach in social and political contexts like that framing the Hanford cleanup.

Our approach is to employ procedural criteria developed by Webler[15] to evaluate the quality of the deliberation that occurred among DOE-RL and its contractors and representatives of Hanford region Indian tribes, the Hanford Advisory Board (HAB), and federal and state regulatory agencies (U.S. EPA and the Washington Department of Ecology). From this perspective, language becomes the basic currency of exchange in communal, problem-solving efforts. This approach highlights the nature of the discourse that occurs among participants over time and permits evaluation of that discourse in terms of implications for two basic procedural dimensions—fairness and competence. Webler's framework thus makes it possible to examine procedural breakdowns for their origins in the discourse that led to them and to trace their ripples outward to the results the participants ultimately achieve.

The parties to the CRCIA encountered numerous process difficulties and, in the end, achieved uncertain results. This underscores not only the importance of fair and competent deliberative process, but also the difficulty of overcoming the influence of broader, context-specific factors on deliberations like the CRCIA. Inherent inequalities in power, a long history of mistrust, and basic differences in the ways parties perceived a range of attributes of the risks whose impacts were to be evaluated, falling generally into the ''scale,'' ''interactivity,'' and ''contingency'' categories discussed by Jasanoff,[5] taken together, appear to explain the outcome of the CRCIA effort.

In spite of the ''failure'' of the CRCIA as originally construed, it nevertheless lives on at Hanford, having seemingly transmuted into a newer DOE initiative, the ''Hanford Groundwater/Vadose Zone Integration Project,'' an intended broad-based assessment of the implications for site cleanup of the recent discovery that vadose zone and groundwater contamination at Hanford is much more extensive than previously thought.[3] This suggests that focusing exclusively on a single participatory risk assessment effort via micro-level analysis runs the risk that one is unable to account for the influence of broader external social and political influences on the results obtained. To what extent has a particular participatory process failed if it lives on in a variety of different guises? Consideration of the broader context of the CRCIA, the subject of the last section of this article, leads us to conclude that macro-level analysis of the type proposed by Laird is a necessary adjunct to micro-level analysis. Discourse analysis by itself cannot help us gauge the influence of diverse political factors on the outcomes observed, and in fact is largely silent on the question of judging outcomes. Nevertheless, discourse analysis has great value in pointing toward the types of circumstantial influences for which we should look, as we believe this study demonstrates.

2. HANFORD AND THE COLUMBIA RIVER

Between 1945 and 1987, plutonium was produced at the 560-square-mile Hanford Nuclear Reservation in southeastern Washington. Hanford was chosen as the wartime Manhattan Project's site for plutonium production not only for its remote location, but also for its proximity to the Columbia River, which flows through the site's northern portion and forms part of its eastern boundary. As the second largest river in the United States, the Columbia offered an abundant supply of cooling water for the production reactors. Hanford was the first production facility in the United States, and one of only three sites within the nuclear complex with chemical separations capabilities. This component of the fuel cycle, in which spent nuclear fuel and targets were dissolved to isolate and concentrate plutonium, generated large volumes of high-level radioactive wastes. Fifty-five million gallons of these processing wastes are now stored in 177 underground storage

[3] Information on the CRCIA and its relationship to the Hanford Groundwater/Vadose Zone Integration Project can be viewed at http://www.hanford.gov/crcia/crcia.htm (October 23, 2000).

tanks, at least 67 of which have leaked wastes into the surrounding soil.

These leaks contribute to extensive contaminant plumes in the subsurface, mostly the products of waste processing and tank farm operations. The radionuclides tritium, uranium, iodine-129, strontium-90, and technetium-99 are intermingled with numerous plumes of nonradioactive contaminants, including toxic heavy metals and organic compounds. Although estimates are subject to considerable uncertainty, hundreds of billions of gallons of radioactively contaminated wastewater were discharged into unlined pits and trenches or directly to the ground during the Hanford Site's operational period.

A total of 1.4 million curies of radioactivity are now estimated to be present in soils and groundwater at Hanford.[18] Despite most operations having taken place on the Hanford Reservation's central plateau, far from the Columbia, at least one contaminant plume originated there, tritium, is now known to be impinging on the river. Hanford's groundwater thus provides a major pathway for contaminants to reach the Columbia.

The nine plutonium production reactors located near the Columbia utilized once-through cooling systems coupled to unlined settling ponds. The result is a substantial legacy of contamination of soils and groundwater in the vicinity of the reactors, and hence very near to the river itself. Strontium-90 and chromium (used to prevent corrosion) are particularly problematic, as both now appear in springs and seeps along the river, in deep-rooted herbaceous plants growing along the banks, and in salmon spawning areas within the river bed itself.[19,20] When the N-Reactor was suddenly shut down in the mid-1980s, never to be restarted, uranium fuel elements were orphaned in adjacent water-filled concrete holding basins. Now held in water whose level requires constant monitoring, these fuel rods are decaying into a highly radioactive sludge, posing perhaps the most imminent safety hazard among the many environmental problems that are the Hanford legacy.

Hanford's DOE managers, like their predecessors in the Atomic Energy Commission, and before that, the Manhattan Project, have generally relied on technocratic approaches to decision making. Such approaches have the potential to conflict with democratic ideals. Gerber[21] describes the war years as a time when the "series of checks and balances that normally guard the American government against excesses was … virtually inoperative." Subjugation of democratic process continued throughout the early 1950s, when the nuclear weapons production network expanded its capacities nationwide. Not until the Cold War ended and the mission of most nuclear complex sites shifted to cleanup did DOE begin to actively engage citizen stakeholders in its remediation efforts. In addition to the more traditional review-and-comment mode of public participation, DOE has begun to use citizen advisory boards as a means of incorporating public input into the administrative decision-making process.

Citizen advisory boards, which DOE calls Site-Specific Advisory Boards (SSABs), have been created for sites throughout the nuclear weapons complex. SSAB members are expected to provide advice on key clean-up decisions to decisionmakers. DOE officials must in turn define and clearly communicate their decision-making process to the Board. They must inform Board members of actions resulting from recommendations; if recommendations are not accepted, an explanation must be given. Representatives from state, tribal, and local governments, and the EPA are also encouraged to attend and participate.[4]

Three federally recognized tribes, the Nez Perce Tribe (NPT), Yakima Indian Nation (YIN), and Confederated Tribes of the Umatilla Indian Reservation (CTUIR), have special rights and interests in the land currently occupied by Hanford facilities and the fishery resources potentially affected by its contaminants. Indigenous peoples have lived in the Columbia Basin since time immemorial. In 1855, a number of treaties were signed between the United States and several northwest tribes. Native Americans ceded title to area lands in return for protected access to resources within and outside reservation boundaries, and acknowledgment of tribal sovereignty. Today, tribal peoples routinely access portions of the Hanford Site to gather foods and medicines important for traditional religious practices, and co-manage the Site's cultural resources. However, tribal representatives have been desirous of seeing an expansion of their role in DOE's decision making on the Hanford cleanup.

The Columbia River is a drinking water source for the Tri-Cities, which are located directly downstream from Hanford, and is used extensively for

[4] See Boiko *et al.*[11] for a more detailed description of DOE's SSABs, and an analysis of the establishment of the Hanford Advisory Board.

crop irrigation. The Hanford Reach, that portion of the Columbia between the Priest Rapids and McNary Dams where Hanford's nine plutonium production reactors are located, is also used for a variety of recreational activities. The river and its resources, particularly salmon, are central to tribal cultures. The Hanford Reach is an important spawning area for Chinook salmon, several stocks of which have recently been listed as ''threatened'' under the Endangered Species Act.

Thus many resources, uses, and claims are established for the Hanford Reservation and the adjacent Columbia River, despite site cleanup having barely begun. These are juxtaposed against the problems posed by the continuing presence of a variety of contaminants and hazards. It is in this context that the CRCIA emerged. Its original purpose was to establish a screening-level estimate of the risk that Hanford-derived contaminants pose in the aggregate to the Columbia River and its resources, as a guide to remedial action under CERCLA, the federal ''Superfund'' law.

2.1. The Columbia River Comprehensive Impact Assessment

Of all the concerns the Northwest's citizens have regarding the Hanford Site and its cleanup, perhaps none is more important than the possibility that Hanford's contaminants could negatively affect the Columbia River. This concern served as an impetus for a Tri-Party Agreement (TPA)-initiated study to determine the degree to which Hanford contaminants impact the river.[5] The Columbia River Comprehensive Impact Assessment, or CRCIA, was not a typical technical analysis, however. Tribal and stakeholder representatives had seats on the CRCIA Project Management Team and, in the parlance of NRC's analytic-deliberative process,(3) participated as ''equally valid contributors.'' Unfortunately, by the end of the CRCIA's initial phase, DOE had withdrawn from the process and essentially rejected much of the representatives' work.

The CRCIA assessment was unlike many regulatorily driven technical processes, where stakeholder involvement consists of public review and comment periods. Early on DOE-RL invited EPA and the Washington Department of Ecology (Ecology) project managers to attend internal DOE-RL project meetings. Instead of forming a separate advisory board for tribal participation, DOE-RL then invited representatives from the principal tribal organizations in the region to become members of the CRCIA Project Management Team. When the Oregon State Department of Energy (Oregon) and the Hanford Advisory Board (HAB) expressed interest in the project, they too were invited to participate.

The CRCIA was initially designed to enable regulators to determine how much the river has been impacted by Hanford's operations, and what types of CERCLA remedial actions could minimize the resulting risks. Although considerable data exists on Hanford releases to the Columbia, this information had never been tied together in one assessment. The CRCIA was conceived to do just that. The word ''comprehensive'' was in the TPA milestone language; however, its interpretation created some consequential differences in project participants' expectations for the final project. DOE's original intent was to use existing data to assess the risk posed by current conditions. Non-DOE representatives on the CRCIA Project Management Team had a very different notion of what an assessment called ''comprehensive'' would look like, but acknowledged that time and budget constraints limited the scope of the effort. The Team eventually agreed to produce a scoping-level assessment to determine if interim remedial actions were necessary (what would become CRCIA Part I), and to write a chapter for the final report that defines what additional work needs to be done to produce a truly comprehensive assessment (what would become CRCIA Part II).

Soon thereafter, this comprehensive ''chapter'' took on a life of its own and ended up becoming a separate document. Whenever an idea was deemed too ambitious for the screening assessment, it was relegated to Part II. In effect, this partitioning exacerbated the existing schism in the Project Management Team: DOE-RL and its contractors were able to take control of the Part I assessment, while the tribal representatives simultaneously

[5] The Tri-Party Agreement (TPA) is a federal facility consent order designed to bring the Hanford Site into compliance with environmental laws. Signed in 1989 by the DOE, the Environmental Protection Agency, and the Washington State Department of Ecology, the TPA contains dates, or milestones, by which certain clean-up activities must be complete. The TPA also established a division of authority for clean-up tasks: DOE is the lead agency, which means it has the primary responsibility for coordinating clean-up efforts, while EPA and Ecology serve as regulators with enforcement powers.

drove Part II. This complicated the already ambiguous Project Management Team structure and blocked Teamwide consensus.

DOE-RL's goals for the CRCIA Project Management Team were never made explicit; hence the parties appeared to have differing expectations regarding their influence, and legal decision-making authority became an issue throughout the negotiations. The Team was a hybrid participatory mechanism, as it displayed characteristics of both a citizen advisory board and a regulatory negotiation. It began as a mechanism for government-to-government consultation (in seeming acknowledgement of the tribes' status as self-governing entities), but then appeared to become more of a consensus-driven process.

The Team was not chartered under FACA (the Federal Advisory Committees Act), as both citizen advisory boards and regulatory negotiation committees are required to be. Regulatory negotiation generally brings together representatives of different interests in an effort to negotiate the content and language of regulations. A participating agency is a party to the negotiations, and thus explicitly shares decision authority with the other representatives. An agency convening a citizen advisory board, on the other hand, does not participate in board debates and thus the board's recommendations are nonbinding. Unlike government-to-government consultation processes, both have an objective of consensus. However, the consensus reached through a regulatory negotiation process must be consistent with the agency's statutory authority. The evolution of the CRCIA Team confused its decision authority—Was DOE in charge, or would decisions the Team made as a whole be implemented? Even in the Team's final documents, the message is mixed (see note 6).

At the weekly Management Team meetings, tribal and stakeholder participants were generally outnumbered by technical contractor representatives (Table I). Communication did not flow in just one direction from these contractors to the tribes and stakeholders, however. The meetings were structured in a manner that allowed tribal, community, and regulator representatives to communicate directly with the contractors conducting the screening assessment. In some respects, meetings shared characteristics with the convergence model described by Bradbury.[22] Morning sessions of the meetings tended to focus on the comprehensiveness issue, while the scoping assessment was discussed in the afternoons. Some attendees were present at one session or the other but not both; this is especially true of technical contractors, many of whom attended only afternoon meetings.

Table I. CRCIA Project Management Team Meeting Participation

	Total number of attendees at all meetings	Average representation per meeting
DOE	48	2
DOE contractors	158	6.6
EPA	18	0.75
Ecology	47	2
Oregon	17	0.71
YIN	30	1.25
NPT	27	1.13
CTUIR	24	1
HAB	16	0.67

Data from 24 representative meetings from 8/29/95 through 7/2/96. An average of 16 participants attended each meeting.

Although DOE-RL was required by the TPA to publish Part II, it never endorsed or approved the opinions, conclusions, or recommendations espoused therein.[6] Following completion in mid-1997 of the TPA Milestone that gave rise to the CRCIA, DOE attempted to split the CRCIA Project Management Team into separate HAB-based and tribal components and to narrow the scope of the follow-up studies to be conducted. This move was strongly opposed by the HAB, the participating agencies, and the tribes, all of whom expressed fears that the integrative approach the CRCIA had fostered was now being abandoned. DOE relented, and though the CRCIA Management Team in theory exists today as it did during the writing of the CRCIA documents, its role in furthering integrative approaches to site cleanup is unclear.

[6] The Part II CRCIA document includes a disclaimer that states, ''Publication … is being performed as a public service … [and] does not constitute endorsement of the opinions, conclusions, or recommendations contained therein by the U.S. DOE. … For Part II, the role of the U.S. DOE was not to negotiate its position with respect to the individual requirements as they were being discussed, but to host meetings and participate in a non-negotiating role in the development of the requirements as a total package … Thus, the term 'CRCIA Team' as used in Part II refers to the team members described in 'Requirements for a Columbia River Comprehensive Impact Assessment', with DOE playing a hosting and non-negotiating role.''[24]

2.2. CRCIA Part I: Screening Assessment

The purpose of the CRCIA Part I screening assessment was to "identify areas where the greatest potential exists for adverse effects on humans or the environment."[23] It was a scoping-level assessment, which was to be used to indicate whether the issues being studied were serious enough to warrant further investigation or remedial action. The assessment was conducted by a DOE contractor, in consultation with the CRCIA Project Management Team.

Part I focused on 28 contaminants selected from a set of 100 potential contaminants. These contaminants of interest were chosen using a multistage screening process designed to identify the dominant contributors to environmental or human health risks. In a similar manner, the species of interest set was narrowed to 52 species, from the 368 species known to exist in the study area, by applying criteria constructed to provide balance across taxonomic groups and exposure pathways. Limiting the geographic and temporal scopes also served to constrain the assessment's complexity.

Twelve human exposure scenarios were used in the Part I assessment to demonstrate the potential range of risks associated with various activities. Included were a few slightly modified standard EPA scenarios and some developed specifically for the CRCIA. The most important of this second category were five Native American scenarios developed by the CTUIR representative. These scenarios are perhaps the only significant nonagency Project Team member contribution to Part I. The Subsistence Resident, Upland Hunter, River-Focused Hunter/Fisher, and Columbia River Island User scenarios were specifically developed for Columbia Basin climatic conditions, ecosystems, and indigenous activity patterns.[7]

The results of the Part I assessment identified contaminants that posed a significant potential risk, ecological receptors most likely to be exposed to elevated levels of contaminants, media where contaminants concentrated, pathways by which contaminants reached receptors, the location of contaminant hot spots, and types of activities that could result in adverse exposure to contaminants.

[7] For information on the development of these scenarios, see Harris and Harper[25] and Harper.[26]

2.3. CRCIA Part II: Participant Requirements for a "Comprehensive" Impact Assessment

The CRCIA Part II is a compilation of prescriptions for what would constitute a truly comprehensive assessment in the eyes of its authors—namely, tribal, stakeholder, and regulatory agency representatives. The objective was to design such an assessment, but not to conduct it. That the task was seen by its authors (a group that did not include DOE representatives, see note 6) as one of developing a fundamentally new approach to evaluating Hanford impacts is clear from the self-described purpose of Part II. Part II was characterized by its authors as "defin[ing] a new paradigm for predecisional participation by those affected by Hanford Cleanup decisions."[24] The type of predecisional participation the authors speak of is an oversight role in the day-to-day work of conducting risk assessments. Were their ideas to be implemented by the DOE, the management of assessment work would be carried out by a board composed of representatives from the socioeconomic groups who are affected by Hanford's clean-up and disposal decisions. This citizen management board, called the CRCIA Board, was envisioned to eliminate the need to make "arbitrary assumptions" during the course of an assessment, as CRCIA Board approval would be required before any assumptions were incorporated into an analysis. In addition, the CRCIA Board would develop its own standards for data quality and maintain final authority over decisions relating to assessment protocols.

The framework presented in Part II broadened the fundamental concepts of receptor and impact along with the spatial and temporal aspects of the Part I assessment (Table II). Analysts were encouraged to focus on potential future impacts to the Columbia in addition to current impacts. Any "intrinsically hazardous" substance should be treated as a potential risk and considered in an assessment. The receptor set should include humans, plants, animals, as well as community groups, the culture of the affected populations, and economic viability of commercial groups. Part II's authors expanded human health impacts far beyond carcinogenesis—mutagenic, teratogenic, developmental, neurological, immunological, and metabolic effects should also be assessed—and stressed the importance of societal impacts, such as economic and quality-of-life effects.

Much of the focus of Part II was on improving procedural or methodological aspects of DOE's risk

Table II. A Comparison of the Scopes of CRCIA Part I and Part II

	Part I	Part II
Time Frame	January 1990 through June 1996	1943 until contaminants are no longer harmful
Geographic Extent	Priest Rapids Dam to McNary Dam; includes groundwater 0.5 mile in from the river, and the adjacent riparian zone	Priest Rapids Dam to the river's mouth in Astoria, OR; includes groundwater found in seeps and springs in the riparian zone, as well as groundwater upwellings in the river bottom
Contaminants	12 radionuclides 2 carcinogenic chemicals 13 toxic chemicals	All contaminants released into the environment, including radioactive decay daughter products and chemical compounds expected to occur with time and after reaction with soils, river chemistry, and other chemicals*
Receptors	Humans and 52 other species of aquatic, riparian, and terrestrial biota	River-dependent humans, plants, animals, and community groups; the culture of affected populations; the economic viability of commercial groups
Impacts	Toxic and carcinogenic human health effects; chronic and acute injury to individual species	Human health effects: acute, chronic, mutagenic, teratogenic, developmental, neurological, immunological, metabolic Environmental effects: direct mortality; damage to ecosystem robustness, resiliency, viability, and sustainability Other effects: quality of life, cultural, usability of resources, economic*

* This listing is the candidate set. Once narrowed through sensitivity and parametric analyses, which sort dominating factors from smaller contributors to the total impact, it would become the study set.

analyses. For example, it was important to the authors that substitution of expert judgment for analytical quantification be avoided unless credibility and reproducibility could be preserved. Sensitivity or parametric analyses, as opposed to expert judgment, should be used to identify and rank factors that dominate the outcome of the assessment. Again, CRCIA Board approval would be required before any assumptions would be implemented. There was also a great deal of attention to data quality. Assessment results should have the accuracy, temporal/spatial resolution, and statistical significance to distinguish among clean-up and disposal alternatives. It was also important to the authors that analysts not dismiss effects simply because ''popular analytical approaches'' cannot assess them. Nor should elevated levels of contaminants be discarded from an assessment because they lie below regulatory standards or have not been linked to adverse effects at low concentrations.

Results of a CRCIA assessment would be dose levels of each dominant contaminant to all receptors, as they vary with time throughout the period of interest, and resultant impacts caused by both individual and multiple contaminants (i.e., additive or synergistic effects). For each of the DOE's visions of a postcleanup end state, there should be a corresponding CRCIA assessment of resultant impacts. While the authors recognized that several important CRCIA objectives lay beyond conventional analytical practices, they still felt *all* impacts—even those generally considered in a qualitative manner—should be considered quantitatively.

Users of the CRCIA assessments would include not only federal and state agencies, but community groups as well. These assessments were designed to guide decisions made by those affected by remediation choices in response to forecasted site conditions. While the authors saw the CRCIA primarily as a tool to estimate the effectiveness of remediation alternatives, CRCIA assessments could also be integrated with other Hanford Site activities, such as strategic planning, environmental impact statements, and budget planning.

Since the publication of the *Scoping Assessment* and *Requirements for a Comprehensive Assessment* documents, what, if any, continuing role the CRCIA Project Management Team has is unclear. There has not been any further TPA action regarding the CRCIA. The ambitious assessment agenda developed under Part II is moving forward, but under the Site's ''Hanford Groundwater/Vadose Zone Integration Project.'' The significance of this programmatic shift is that the follow-up activities are now run through DOE-RL's site contractor, Bechtel Hanford, Inc., with the outside organizations whose representatives made up the CRCIA Management Team relegated once more to their pre-CRCIA roles—review,

comment, and advice.[8] This result is, we believe, symptomatic of shortcomings in the procedural orientation of the DOE's participation mechanisms. On the one hand, the CRCIA process was allowed to evolve in accordance with stakeholder wishes; on the other hand, the results this process produced proved less and less likely to be acceptable to the DOE as the agreed-to process unfolded. These shortcomings are further examined by means of Webler's procedural criteria in the next section.

3. A PROCEDURAL EVALUATION OF THE CRCIA CASE

As noted in Section 1, Webler's[15] procedural normative model of public participation, based as it is on Habermas's theories of how language is used, aims to account for crucial ''micro level'' elements of participation that are easily overlooked when models are based in democratic theory alone. The evaluation criteria he derives thus get to the heart of important procedural issues at an individual, as opposed to a societal, level.

Webler views participation as a highly specialized form of interaction among individuals, so his focus is on the discourse among those actors. This perspective is unusual, if not unique, in the political arena. In the CRCIA case, it is apparent that multiple discourses were in use among members of the Project Management Team, their differing interpretations of the word ''comprehensive'' being a prime example. Webler's model provides a way to look at the power of such linguistic differences in shaping the outcome of a participatory process. The goal of this evaluation of the CRCIA case is to determine if the procedural orientation of the approach the DOE used to involve citizens was *fair* and *competent*, as defined by Webler. We believe that these ''metacriteria'' of Webler's framework encompass the two components of the dilemma that the NRC's analytic-deliberative process[3] was meant to resolve: designing procedural mechanisms for getting meaningful participation on the one hand, and then striking an appropriate balance between technically sound analysis and democratic ideals on the other.

3.1. Webler's Procedural Normative Model of Public Participation

There are three major components of Webler's model: the fairness and competence metacriteria, Habermas's types of discourse, and Habermas's rules for discourse.[16,17] The first elements of the model, the metacriteria, were derived from the literature on what public participation should accomplish and how it should do so. *Fairness* in discourse occurs when all participants take part on an equal footing. Everyone has equal opportunity to determine the agenda and the rules for discourse, to speak and raise questions, and to access knowledge and interpretations. *Competence* refers to a participant articulating and protecting his or her interests, while at the same time being able to contribute to the definition of the collective will. Necessary are not only competent understandings of terms, concepts, and definitions describing physical, social, and personal conditions, but also the ability to come to shared social constructions of reality. Competence thus relates to the adequacy of knowledge selection tools in use. It is a characteristic of the discourse—centered on the rules that coordinate interaction—and not a characteristic of individuals. Thus, a lack of discourse competence *does not* imply that participants are incompetent. Competence is accomplished through the use, by the entire group, of rational, established procedures for knowledge selection.

Next, Webler incorporates elements of Habermas's theory of communicative action, which describes what people do in a discourse. Habermas contends that each speech act makes an appeal implicit in the statement that makes the message meaningful, what he calls a *validity claim.* Different types of speech acts make different types of validity claims (Table III). Each requires a different means by which discourse participants collectively decide whether or not a speaker's assertion is valid, a process called *redemption*. Understanding requires participants to detect what it is about a statement that gives it validity; agreement results when participants then choose the statements that are best or most desirable.

For example, an *explicative discourse* might involve what the term ''high-level'' means when

[8] The ''Hanford Groundwater/Vadose Zone Integration Project,'' website (http://www.bhi-erc.com/vadose/vados.htm) states, ''RL and a team of contractors led by Bechtel Hanford Inc., is currently developing an integrated site-wide plan to characterize the Hanford Site vadose zone and groundwater, and to assess all relevant site programs and plans, with the primary objective of protecting the Columbia River. Involving the Tribal Nations, Stakeholders, and regulators are [*sic*] an integral part of this project plan'' (November 13, 2000).

Table III. Elements of Habermas's Theory of Communicative Action

Speech act	Validity claim	Discourse	Example
Communicative	Comprehensibility	Explicative	High-level waste is stored at Hanford.
Constantive or cognitive	True/correct	Theoretical	Waste from leaking tanks has reached groundwater below the tank farms.
Regulative	Normatively right	Practical (normative)	We should base clean-up decisions on risk, not cost.
Representative or expressive	Truthful/sincere	Therapeutic	I am concerned that radioactive contamination from Hanford will give me cancer.

applied to radioactive waste. During a competent explicative discourse, all terms, definitions, and concepts are made explicit. If there is confusion, comprehensibility issues are resolved by referencing some type of commonly-agreed-upon standard, such as a dictionary, regulatory, or textbook definition. Confirmation that all participants understand what the term means would then be made.

Theoretical discourse involves disputes about facts, which can be gathered through scientific methodologies or daily life experiences. An example relevant to Hanford is discussion regarding wastes detected in the groundwater below the 200 Area. There are two possible sources for such wastes: deliberate discharges of wastes into unlined trenches during the production years, or leaking storage tanks. For participants collectively to determine which discharge is the most likely source, it is necessary to examine physical evidence such as borehole samples and historical records of chemical constituents present in tank versus trench wastes. The participants must choose between these conflicting validity claims by deciding which provides the better description of reality. While one does not have to be a scientist to participate in such a theoretical discourse, someone who wants to challenge an expert's calculations should base his or her arguments in accordance with scientific protocol. Likewise, discourse participants are obligated to recognize the validity of knowledge that meets objective standards (e.g., peer review or repeatability of experiments). Habermas and Webler do grant legitimacy to alternative forms of knowledge, such as anecdotal observations, idiosyncratic observations about local conditions, and traditional knowledge, but call for these knowledge forms to be peer reviewed and/or independently verified as well.

Practical discourse, which to avoid confusion we depart from Habermas and call *normative discourse*, is discussion about social values and norms. The representation of a variety of viewpoints is crucial from both fairness and competence perspectives. For example, proponents of both risk-based and cost-efficient remediation strategies should be present during discussions regarding clean-up priorities. Unlike theoretical and explicative discourse, however, there are no formalized rules or preestablished standards for selecting among competing normative validity claims.

Therapeutic discourse gives a speaker the opportunity to be introspective and to explore the authenticity and subjectivity of his or her beliefs and desires. A shift to theoretical discourse sometimes occurs when expressive claims are ''translated.'' Translation is the challenge of cognitive claims implicit in an expressive validity claim, which leads the discussion to become a theoretical one. For example, a participant is fearful that environmental radiation will cause his dog to grow a third eye. Since this specific fear has no basis in scientific fact, a competent discourse would uncover the established effects of radioactivity on mammals to assuage irrational fears. Translation, however, is not the sole purpose of therapeutic discourse.

The final component of Webler's model is based on Habermas's ''ideal speech situation,'' which can be thought of as his ''rules for discourse.'' When participants meet these requisite conditions, rationally motivated (as opposed to coerced) understanding and/or agreements can emerge from a discourse. Webler modified Habermas's rules to create separate requirements for fairness and competence in discourse. It is important to note that the ideal speech situation is a theoretical conception; Habermas never expected all its conditions to be met during real-world discussions.

3.2. Webler's Discursive Standard Criteria

Based on these three elements, Webler built a set of criteria for evaluating how well participation mechanisms compare to his normative model. This evaluation framework consists of two additional

classes of criteria. First, there are 13 *subcriteria* in two categories—activities and needs (Tables IV and V). The subcriteria are structured so that all needs must be met for each activity. Then there are 34 *evaluation criteria*, each with question sets for determining a participatory mechanism's performance against that criterion. Each evaluation criterion corresponds to a combination of an *activities subcriterion* and a *needs subcriterion*. The question sets, with 85 questions in all, probe procedural elements of a participation mechanism in a way that allows for a systematic qualitative assessment.[9]

3.3. Methods

Using Webler's criteria, the CRCIA case was evaluated to determine if the procedural orientation of the approach the DOE used to involve citizens was ''fair'' and ''competent.'' The evaluation was based on information gleaned from review of Project Management Team meeting minutes,[10] and telephone interviews with three of the participants. The time frame considered began when the Project Management Team was formed, August 1995, and ended with the DOE's official comment on the publication of the draft *Scoping Assessment* and *Requirements for a Comprehensive Assessment* documents, July 1997.

Table IV. Webler's Subcriteria for the Fairness Metacriterion

Activities	Needs
Agenda and rule making	All participants are free to be a participant in the discourse (attend)
Moderation and rule enforcement	All participants are free to make speech acts (initiate)
Discussion	All participants are free to challenge and defend claims (discuss)
	All participants are free to influence the collective consensus (decide)

Table V. Webler's Subcriteria for the Competence Metacriterion

Activities	Needs
Explicative discourse	All participants have access to information and its interpretations (i.e., knowledge)
Theoretical discourse	The best available procedures for knowledge selection are used
Practical discourse	
Therapeutic discourse	

The performance of the CRCIA against Webler's evaluation criteria was rated subjectively by the first author, and subsequently reviewed by the second author, as described below. The first author's approach was first to answer as many questions as possible using the meeting minutes. Next, she asked questions of Project Management Team members to verify those answers, to answer the remaining questions, and to cross-validate interviewees' answers against one another. Interviewees were not asked to respond to Webler's question sets directly; rather, the interviewer asked them general questions regarding how meetings were conducted. These responses were then used to answer Webler's questions as reflections of the information conveyed through the interviews. Since interviewee answers were consistent with one another and with the written meeting minutes, we were satisfied with our understanding of the CRCIA's procedural elements, even though only three interviews were conducted.[11]

Just as analysis of meeting transcripts would have been preferable to reliance on minutes that only summarize what transpired at Project Management Team meetings, so the case could be made that participant observation would have been preferable to after-the-fact interviews. Once the CRCIA process had run to completion, participants likely formed their own opinions regarding its successes and failures and their underlying ''causes.'' What they believe now may have been less apparent to them then—a case of ''20/20 hindsight''—and may not have been apparent to the participant-observer either. Strategic behavior is another potential source of bias, as will become

[9] The question sets and additional details of this method can be examined in either the Appendix of Webler[15] or Appendix A of Guglielmo.[27] The latter is available on the Web at <http://www.sma.washington.edu/people/students/thesis/guglielmo/Index.html>.

[10] Ideally, audiotapes or precise auditive transcripts should have been reviewed to do full justice to the discourse analysis concept. However, we reviewed only written summaries of the Project Management Team meetings, as these were the only records available.

[11] Most of Webler's questions deal with factual issues, as opposed to matters of opinion, so there is little room for deviation. For example: Was everyone able to suggest items for the agenda? Did everyone have equal access to sources for definitions of terms relevant to the discourse? Was there peer review and independent verification of scientific data and knowledge? Was there an effort to achieve representation of formal interest group organizations?

clear in this article's concluding section. In short, language analysis can be very difficult.

The interviewer followed Webler's guidance with respect to scoring and used plus/minus symbols, along with a ''degree of interpretation and flexibility,'' as he recommends, to signify the CRCIA's performance against the evaluation criteria. This process, though highly subjective, resulted in scores for each individual evaluation criterion.[12] If the answer to a majority of questions in a question set was yes, that criterion was given a ''+'' score. If few questions were answered yes, that criterion received a ''–'' score. In intermediate cases where some of the questions were answered yes but numerous others were answered no, that criterion was given an ''s'' score. This scoring system, though ''fuzzy'' in its evaluation approach, is nevertheless in accord with that used by Webler and his colleagues. Using the matrix format developed by Webler, these scores for individual evaluation criteria were combined to formulate scores for the paired ''activities'' and ''needs'' subcriteria that relate to each of the two metacriteria (Tables IV–VII). Thus for each of the metacriteria fairness and competence there were two levels of scoring: the overall score for an evaluation criterion on the basis of answers to several questions (i.e., a question set), and a score for a subcriterion that was based on a particular combination of the evaluation criteria scores developed at the first level.[13] The scoring done by the first author was reviewed by the second author for agreement. Where evaluations differed, discussion ensued to resolve differences. The final scores are tabulated in Tables VI and VII. An example of the scoring approach is provided in the next section.

3.4. Results

CRCIA's performance with respect to Webler's evaluation criteria varied widely. Generally, scores were low for the fairness subcriteria (Table VI) and somewhat higher for the competence subcriteria (Table VII). As an illustration of how the ratings were assigned, consider the following example,

[12] Webler[15] argues that subjectivity is inherent in the application of his framework to case studies.

[13] Refer to Chapter 4 and Appendix B of Guglielmo,[27] available on the Internet at <http://www.sma.washington.edu/people/students/thesis/guglielmo/Index.html> to view the answers to Webler's question sets, their subsequent scoring, and the path to the final score tabulations displayed in the text tables.

Table VI. CRCIA Performance with Respect to Webler's ''Fairness'' Subcriteria*

	Attend	Initiate	Debate	Decide
Agenda and rule making	–	–	–	–
Moderation and rule enforcement	s	+	–	–
Discussion	–	s	s	–

* Scoring: ''+'' means satisfies most criteria, ''s'' means satisfies some criteria, ''–'' means satisfies few criteria, and ''+/s'' or ''s/–'' signify marginally positive or negative scores, respectively. Scores for individual question sets can be found in Guglielmo (1998), Appendix B.

which explains why the ''Agenda and Rule Making/Attend'' cell in Table VI was given a ''–'' score.

According to Webler, a fair participatory process provides all participants with an equal chance to: (1) put their concerns on the agenda and approve or propose discussion of ground rules (his criterion A1, which is further elaborated via two subcriteria in the form of straightforward process-oriented questions);[14] (2) debate and critique proposals for the agenda and rules (criterion A2, elaborated via four questions); and (3) influence the final decision about the agenda and rules (criterion A3, elaborated via two questions). (See also Appendix A of Guglielmo[27] or Appendix of Webler[15].)

Upcoming agenda items for CRCIA Project Management Team meetings were discussed among Team members, although not in a formal, consensually approved, manner. The participants we interviewed felt they had ample opportunity to suggest items for the agenda. Proposals were not debated, however, as almost all suggestions were accommodated; DOE was responsible for preparing finalized written copies of the agenda and circulating them to Team members. Thus only one of the two subcriteria for A1 is satisfied. Moreover, the CRCIA performed

Table VII. CRCIA Performance with Respect to Webler's ''Competence'' Subcriteria

	Access to Knowledge	Best Procedures
Explicative discourse	–	–
Theoretical discourse	+/s	s/–
Practical discourse	s/–	s/–
Therapeutic discourse	s	+/s

[14] The two questions ask whether all participants have equal opportunity to suggest items for the agenda and the underlying rules for discourse, respectively.[15]

less well with respect to rule making *per se*. No explicit discourse or process rules were ever developed for Management Team meetings. All participants interviewed felt this was a *major* weakness of the process—one that is directly related to some of the substantive problems the Team encountered, which are explored more fully below.

Because Webler's framework does not separate agenda making and rule making for scoring purposes, the relative lack of ability of non-DOE participants to influence rules either for agenda setting or for subsequent deliberation, even while successful in having their substantive concerns placed onto the agenda by the DOE, means that relatively few of the eight subcriteria associated with criteria A1–A3 are satisfied. Hence, we scored the CRCIA's overall performance with respect to this activities subcriterion as negative. To our interviewees, the lack of clear process rules was a negative aspect of the CRCIA that far outweighed the positive feelings they had regarding their ability to get items onto the agenda for discussion. (Chapter 4 and Appendix B of Guglielmo[27] describes more fully the logic behind this and other subcriteria scores.)

A lack of attention to process rules clearly hampered the CRCIA project, an observation that we believe has implications for the implementation of models like the analytic-deliberative process model for achieving consensus over nuclear complex clean-up decisions. Three major procedural weaknesses made consensus unattainable for the CRCIA Project Management Team. First, the DOE representative to the Team was not given full support by his management (i.e., decisions reached by the Management Team were not necessarily ratified by DOE). As a result, DOE could not fully contribute to the emergence, through deliberation, of shared understandings and agreements. Second, no formal dispute resolution mechanisms were employed during meetings. Decisions were made in a haphazard fashion and the parties were never able to collectively form a coherent path forward. For instance, when asked how decisions were made, one interviewee said that generally ''the most stubborn person won because others gave up in frustration.'' By contrast, consensus, when viewed through Webler's model, results from a competent discourse in which participants reach agreement through rational, reliable techniques for knowledge selection.

Finally, a lack of attention to comprehensibility problems resulted in confusion and, often, more vigorous arguments. Comprehensibility problems (i.e., lack of shared or mutually understood meanings for terms, definitions, or other concepts) often provided a quick way to launch a rehash of normative debates over power relations, making the working environment increasingly adversarial and clouding substantive issues. As a result, explicative discourse, theoretically the most straightforward discourse form, had the only overall negative scores among the discourse types. The three other types each satisfied at least some of Webler's evaluation criteria.

One such comprehensibility issue arose during a meeting designed to integrate the CRCIA with DOE-RL's then emerging Groundwater/Vadose Zone Integration Project, which occurred after the Part I and Part II documents had been published. The YIN representative on the Management Team used the word ''standard'' to describe specifications for what data should be included in a CRCIA assessment, and what could be tossed out (i.e., assessment standards for time frame, source terms). The DOE and contractor personnel took ''standard'' to mean regulatory criteria (i.e., a standard for tritium in drinking water). This misunderstanding led to a dispute over whether the CRCIA Team had the legal authority to set standards, while the point that the YIN representative was trying to make—that there must be data standards in relation to developing risk assessment information—went unaddressed.

Perhaps the most important observation to come from the evaluation is that all parties to the discourse were not able to challenge all the validity claims put forth during discussions. The ability of all discourse participants to make, challenge, and defend all four types of validity claims is a central tenet of Webler's model. Tribal/stakeholder representatives often lacked the technical information to make or challenge cognitive validity claims, and they were not provided with the opportunity or means to acquire such information. By the same token, since these tribal/stakeholder representatives were invited to join the Management Team specifically so that their normative claims could be incorporated into what was viewed as a theoretical exercise, agency personnel apparently did not feel as if they were in a position to challenge the normative validity claims those representatives made. Essentially, some participants favored one type of discourse at the same time others engaged in a different type. As a result, two largely unrelated visions of risk emerged from the Team.

A striking example of this theoretical-normative discourse disconnect involves the tribal exposure scenarios used in the Part I scoping assessment. Although the DOE's technical representatives believed some of the CTUIR representative's parameter values to be unrealistic, they printed the scenarios as he presented them. DOE did not engage tribal representatives in a discourse to resolve the differing perspectives, they simply printed—but later criticized—the scenarios.

Although the CRCIA did display many features of the analytic-deliberative approach outlined in *Understanding Risk,*[3] its analysis and deliberation components were not integrated to the extent recommended by the NRC. The parties interacted well in the beginning, but their work gradually grew apart as more and more suggestions were deemed beyond the scope of Part I and hence relegated to Part II. The deliberation work (i.e., Part II's effort to identify what ''should'' be included in a so-called comprehensive assessment) did not inform or frame the analysis work (i.e., Part I's scoping assessment). Of all the ideas generated by the tribal/stakeholder representatives, only the tribal exposure scenarios were actually incorporated into the Part I analysis.

Perhaps most basic of all, fundamental differences in views on the nature of risk and the ability of remediation to reduce risk were not resolved and apparently not even recognized by the group as a whole. The authors of Part I had the view that contaminant levels and risk would be reduced through time as a result of remediation, while the authors of Part II continued to maintain that the highest risks would occur in the future, regardless of the DOE's best efforts at remediation in the present. The systematic failure to recognize and reconcile such differences can at least partially be attributed to the theoretical-normative discourse disconnect described above.

4. LESSONS FROM THE CRCIA

After-the-fact procedural evaluation of deliberative processes like the CRCIA can provide important ''micro level'' insights into their strengths and weaknesses, as this assessment demonstrates. Relatively subtle process breakdowns, such as occurred in the CRCIA, can be identified via their expressions in the quality of communicative discourse. Less clear from such a micro-level perspective, however, is what strategies, proactively applied, might have led to a fairer and more competent discourse, and an outcome perceived by the participants to have been more successful. Might, for example, features of the NRC's analytic-deliberative process not utilized during the CRCIA have changed the dynamics of the process to produce a different outcome? Our consideration of this and related questions leads us to the observations discussed in this concluding section. One basic conclusion is that well-applied analysis-aided deliberation, as typified by the NRC's analytic-deliberative process model, can improve the process of exercises like the CRCIA, but not eliminate the deeper disconnects that influenced the CRCIA's conduct.

4.1. Reflections on the Analytic-Deliberative Process

On the surface, our procedural evaluation addresses a rather narrow set of considerations compared to the objectives set developed by the NRC committee for its analytic-deliberative process. From their perspective we have asked only whether the CRCIA ''got the participation right.''[15] Our results lead us to a somewhat different conclusion however, one that suggests an ordering of objectives not apparent in the NRC study.

Where the analytic-deliberative approach is grounded in five independent objectives, two for the analysis, two for the deliberation, and one for synthesis, the lesson of the CRCIA seems to be that the deliberative objective of ''getting the participation right'' is an important instrumental objective to both the NRC's objectives for the analysis—''getting the science right'' and ''getting the right science.'' The debate within the CRCIA over whether the ''right'' science was being employed was resolved via deferral to Part II of those questions regarded as requiring scientific approaches outside the well-circumscribed confines of current, CERCLA-driven, risk assessment practice (Table II). The theoretical-normative discourse disconnect that occurred within this debate expressed itself as an implication, on the part of the preparers of Part I, that scientific approaches whose protocols were not those of CERCLA-style risk science were ''wrong'' scientific approaches. In the absence of redemption of such claims, the other implication was that the legitimacy of the normative

[15] The five objectives developed by the NRC committee are: ''getting the science right,'' ''getting the right science,'' ''getting the right participation,'' ''getting the participation right,'' and ''developing an accurate, balanced and informative synthesis.''[3]

concerns the science was intended to address was also suspect.

A second observation concerns what decision analysts refer to as the ''measurable attributes'' of the objective of ''getting the participation right.'' Scientific norms for field measurements, data analysis, and data quality are offered as the appropriate means for judging whether the objective of ''getting the science right'' is being fulfilled in collaborative risk assessments in the NRC's *Understanding Risk*. This study suggests that the framework developed by Webler and utilized in our analysis of the CRCIA can play a similar function in the qualitative assessment of the fairness and competence (i.e., ''rightness'') of the deliberative aspects of these same expert-public collaborations. Just as the practice of natural science has spawned protocols for judging the quality of scientific enterprise, so social scientists can develop protocols for judging the quality of deliberation.[28]

Our final comment on the analytic-deliberative process is both broader and more cautionary. Our results lead us to ask whether fixing the details of deliberative process, from whatever perspective, can suffice to improve the mutuality of risk characterization when prior history and present political context also frame the deliberation that attempts to address risk in a collaborative way. We take this question up in our next, and concluding, section.

4.2. Importance of Macro-Level Context to Interpreting the Lessons of Micro-Level Analysis

The CRCIA neither emerged at Hanford as a *de novo* activity, nor, over its year-and-a-half life, did it exist in a vacuum. As a consequence, it is not easily classified via the NRC Committee's vision of the ''Risk Decision Landscape'' (p. 137 ff.).[3] The CRCIA had a past, a present, and a future, and understanding the earlier evolutions that led to and framed it, the dynamics that changed it as it evolved, and the effect its coming and going has had on other, ongoing deliberations regarding the Hanford cleanup is vital to assessing its ultimate impact. Broad contextual factors outside the CRCIA itself defined and influenced the interactions among participating parties, affecting outcomes at every stage.

The relevance of such factors is difficult to assess both from the NRC's perspective and from that of participatory analysis. Macro-scale features of models like Laird's pluralism model of democratic process, and contextual factors like those pointed to by Jasanoff, can both help frame understanding. As Jasanoff put it in her 1993 guest editorial in this journal:

> How people interpret a given set of facts about risk may depend on a host of variables, such as their institutional affiliations, their trust in the information provider, their prior experience with similar risk situations, and their power to influence the source of the risk. (p. 127)[5]

4.2.1. The Past: Power Relations

To the extent that the CRCIA was a negotiation, it was negotiation among parties of inherently unequal power. The tribes and other participants had virtually no ability through the CRCIA to get the DOE to adopt risk management measures it was not willing to adopt voluntarily. Beyond that, the situation of power relationships among CRCIA participants was extraordinarily complex.

The tribes of the Hanford region do not participate except informally on the Hanford Advisory Board (HAB), the principal mechanism for citizen input to DOE decisions regarding Hanford. This is in accord with their position that, as treaty tribes, they are sovereigns whose appropriate role vis à vis DOE is that of government-to-government consultation. With the CRCIA, however, the visibility of tribal representatives relative to that of the stakeholder communities represented on the HAB was reversed somewhat from the usual. The tribes played a prominent role while the roles of the HAB, and of state and federal regulatory agency co-signers of the Hanford Triparty Agreement, were somewhat diminished.

When a debate is structured in technical terms, as is any risk analysis by definition, citizens who are not technical specialists have less to contribute; the debate becomes dominated by the institutions that can afford the necessary expertise.[14] In the CRCIA case, this turned out to be the tribes, who had relatively better access to technical expertise than other stakeholder participants, a result of the fact that the DOE provides financial resources to tribes and other organized interests intended to enhance their ability to engage in technical debate. Even the CRCIA's Part II restricted its definition of risk to a quantity that can be measured. This is still a form of technocracy, despite the fact that the process that created Part II was open to nonspecialists. The social and cultural content is there, but it is still framed in

technical terms. Given the basic terms of reference under which the CRCIA was created, by insisting on quantification, the tribes were maximizing their chances of influencing DOE, the most important of the other social participants. This is not necessarily the same as reaching shared understanding through risk characterization.

The CRCIA thus seems to have become at least in part a mechanism for the tribes to use in trying to equilibrate the historic power imbalance vis à vis DOE. The Yakama Tribe in particular regards the portions of the Hanford Reservation they ceded as their land and wants to participate in managing site risks, even though the DOE does not acknowledge sovereignty to the extent the tribes feel is appropriate. The CRCIA was thus a means to increase tribal authority over the assessment phase. Unable to influence the *output* of DOE risk decision processes as much as they would have liked, it appears that the tribes hoped to gain more control over the *input* through the CRCIA, where the prospects were relatively good that the DOE could be persuaded to look at risks at least in part from a tribal perspective (Section 2.2). As Edelman[29] suggests, using the jargon of an administrative agency (in this case, the language of risk assessment) can be a powerful way of expressing belonging.

4.2.2. The Present as Prologue to the Future: A Changing Decision Problem in a Dynamic Context

The NRC Committee attempted to classify the appropriateness of risk decision situations to the analytic-deliberative process in terms of a classic, decision-analytic typology of decision types. The CRCIA never fit any of the typical decision types very well however, and as it evolved it grew less and less coupled to any decision at all. As has been observed in numerous studies of bargaining in practice, such ''fuzzing up'' of the ultimate objective can work much to the advantage of completing the task at hand while the job of resolving the really tough issues is shelved.[30] The battle can be won, while the war is not necessarily lost. Such, seemingly, was the case with the CRCIA.

The CRCIA was originally intended to inform decisions about what additional CERCLA remedial actions were necessary at Hanford. What was already an ambiguous situation, with numerous contested remedial action proposals under debate, became more ambiguous as the CRCIA moved away from this initial vision. Soon it was being seen by participants as a one-time chance to forge a template for future remediation decisions, with broad implications for what the extent of its reach might ultimately prove to be. The CRCIA was able to proceed because entanglement with preexisting stalemates over future land use and associated clean-up levels in particular portions of the Hanford Site could be avoided. But the cost was that commitment to the risk characterization principles that emerged could prove very costly to the DOE.

Although the DOE distanced itself from the CRCIA at its end, continued interaction with stakeholders at the site since then has led to resurfacing of the principles and purposes the CRCIA embodied. The periodic emergence of new angles and dimensions of the Hanford clean-up problem tends to bring the same participants together over and over again in an evolving situation that bears the imprint of past interaction. Most recently, the confirmation that contaminants from tank farm operations in the Hanford Site's central plateau have reached groundwater has renewed interest in the kind of broad assessment of risks to the Columbia River that led to the CRCIA, this time in the guise of the Groundwater/Vadose Zone Integration Project.

Jasanoff[5] has suggested that inadequate attention to the qualitative factors of ''scale'' (spatial, temporal, and cross-cultural), ''interactivity'' (production of risk through interplay of nature and society), and ''contingency'' (context dependency of risk knowledge) increases the likelihood of expert-expert and expert-public disagreement. The lessons of the CRCIA reinforce and amplify this notion. The decision to deal with scale differences by ''binning'' risk items into Part I vs. Part II, depending on implied scale of effect, did not serve to redress the fundamental disconnect these different visions of relevant risk represented. The explicit factors of scale that drove this sorting of risks were temporal and spatial, but the implicit factors were cultural.

That the risks the presence of radioactive contaminants at Hanford represent were created by the DOE's antecedent agencies, and in the view of some made worse by DOE inaction or inattention, are also factors that appear not to be separable from the process of participatory risk assessment at Hanford. Whether intentionally or not, the CRCIA Part II framework serves to underscore the reprehensible nature of the government's past actions at Hanford. By the nature of its design, the assessments

its risk models would produce would generate moral outrage, thereby creating an imperative for action. The suggestion is that selecting the ''right'' science will not be a straightforward task if participants view ''right'' science as that which produces culpability. When participants are separated by different ideological and moral stances, and these stances are strongly linked to the positions they take on policy questions, neither science nor deliberation may be able to do much to produce an outcome mutually satisfactory to all participants.[31][16] Reconnecting the technical minutiae of risk assessment with the larger vision of risk remains a major challenge.[5]

When the problem is theoretical-normative disconnect, as we interpret it to have been in the CRCIA, technical assistance that enables all representatives to challenge the theoretical claims made by others could help. From a slightly different perspective, much might be gained by self-conscious attention to conceptual aspects of group process design, such as through professional facilitation.[32] Facilitation was attempted early on in the CRCIA process, though soon rejected as ineffective. Also useful would be the presence, on the project management team, of a variety of viewpoints both able and willing to contribute to a robust normative debate. In retrospect, the CRCIA provided none of these. In the broader scheme of things, however, this assessment suggests that isolated exercises in participatory risk assessment, no matter how well conducted, will not serve to untangle the knots into which perceptions of risk, justice, and the meaning of history are presently tied at many of the nation's legacy nuclear sites.

By contrast, the deficiencies we have identified come from a parsing of the most basic building blocks of societal debate about risk—language itself. The premise of the micro-level analysis we conducted is that it is sufficient to compare the discourse that took place with an idealized situation, which Habermas himself acknowledges is unlikely to be realized in real-world debate. Thus, nearly every participatory process will be found deficient in some way by this standard, even those judged by participants to have come to much more favorable conclusions than was the CRCIA. Put another way, pointing to theoretical-normative disconnect as a problem is not the same thing as dooming the process itself to failure. Nor can ''getting the participation right'' be considered a formula for success, particularly for problems that have histories and social and political contexts like that of the Hanford cleanup. Moreover, we can imagine a great many contexts in which scientists and technical specialists would feel compelled to ''bin'' things they feel well equipped to deal with (e.g., the CRCIA's Part I) differently from items where they feel less secure as to methodological approach (e.g., the CRCIA's Part II)—it's part of the training. While many things no doubt contributed to the muddled outcome of the CRCIA, our broader point is that the considerations one is led to by discourse analysis appear to be valuable aids to putting the analytic-deliberative process into practice.

[16] Strictly speaking, discourse analysis does not provide a basis for judging the success of *outcomes*, focusing as it does on the quality of *participation*. The implication is that better participation leads to improved understanding, as noted in Section 1. Individual satisfaction with outcome is a participant-focused measure that was clearly of great importance to our interviewees, who were not satisfied with the outcome of the CRCIA.

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